

Triple oxygen isotope fractionation during rapid dehydration of amphibole and serpentine

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This study explored the nature of triple oxygen isotope fractionations occurring during the rapid dehydration of hydrous minerals amphibole and serpentine upon lasing. We measured the triple oxygen isotope compositions of the bulk minerals, dehydrated residuals (hereafter residue), and the released water of five hydroxyl-bearing minerals, including two amphiboles and three serpentines. After heating, the serpentines were transformed into anhydrous olivine, accompanied by a notable reduction in the –OH stretching bonds. In general, the residues are isotopically enriched in oxygen ^{18}O , following a slope of ~ 0.5 in the $\delta'^{17}\text{O} - \delta'^{18}\text{O}$ space with a concomitant decrease of ^{18}O in the released water. We found that the oxygen isotope fractionation slopes for two amphiboles (0.5157 ± 0.0002 and 0.518 ± 0.002) are significantly higher than those for the three serpentines (0.501 ± 0.007 , 0.512 ± 0.002 , and 0.501 ± 0.008), and all these obtained slopes are much lower than that of the expected in equilibrium at the high-temperature limit (0.5305). The indicated presence of non-negligible kinetic isotope effects highlights the significance of accounting for potential isotopic alterations arising from kinetic fractionation when analyzing samples that have undergone dehydration.